Section 6-8: Direct Variation

By the end of this lesson, you should be able to answer:

- How do you solve problems involving direct variation and direct square variation functions?

Where you might see this in the real world:

- Finance, biology, physics, business

Define the following terms:

1. Direct variation

2. Constant of variation

3. Direct square variation

Some linear functions that we work with will give the same ratio when we divide each value in the range by its corresponding value in the domain. In other words, when we divide the *y* value by its *x* value, we will get a constant ratio known as the constant of variation. The constant of variation will always be represented by the variable *k*.

When we see this situation, it means we have a direct variation. You will often see it written as "*y* varies directly as *x*." In a direct variation, when one variable gets larger, so does the other variable. This will mean we need to use the direct variation formula:

Notice that this formula is in slope-intercept form, where *k* is our slope, and the *y*-intercept is the point (0, 0).

Example 1: A law discovered by Jacques Charles, a French scientist of the late 18^{th} and early 19^{th} centuries, states that for a fixed amount of gas, the volume varies directly as the temperature. If a gas has a volume of 559 mL at 40°C, what is its volume at 25°C?

You will notice that in our direct variation problem above, we take our constant of variation k and multiply it by x. Sometimes, we will see a direct variation where one value grows faster than the other. One such case is a direct square variation:

Example 2: The distance it takes to stop after you have applied the brakes of a car varies directly as the square of the speed of the car. A car going 64 km/h stops in 27 m. If you are going 90 km/h, how far will the car travel after you have applied the brakes?

As shown in examples 1 and 2, sometimes we will have to find the constant of variation to describe the entire situation. The car that we looked at in Example 2 does not change throughout the problem, so the constant of variation stays the same. We could use the constant of variation to find out how long it would take the car to stop if it was traveling at any rate of speed.

Example 3: Assume y varies directly as x.
a. When $x = 10$, $y = 15$. Find y when $x = 15$.

b. When $x = 3$, $y = 12$. Find y when $x = 21$.

Problem Set:

"THE CONVENTIONAL VIEW SERVES TO PROTECT US FROM THE PAINFUL JOB OF THINKING." – JOHN KENNETH GALBRAITH